Global Illumination for Fun and Profit

Category: Research

1 INTRODUCTION

In sociology, the theory of structural holes developed by Burt [] suggests that if a person links disconnected people, he/she is a structural hole spanner(or bridging a structural hole) and will benefit from such special position. The importance of structural hole spanners is embodied in many aspects. [] shows that the structural hole spanners have more novel ideas than other researchers in academic network as they contact with researchers in different fields. [] shows that the structural hole spanners controls the key path of information diffusion in social networks.

While a series of empirical studies have demonstrated the special role the structural holes spanners play in social network, the measure of determining whether a node is a structural hole spanner or not is controversial. Lou et al. [] present two model to mining top-k structural hole spanners in network. Burt [] presents several metrics to measure ... locally. As there are dozens of models that measure structural hole spanners, judging a structural hole spanner is kind a tricky task.

The challenge of visualizing structural hole spanners:

C1 Identify structural holes in dynamic networks

C2 Visualize structural holes with novel visual representations

C3 Explore and analyze the evolution of structural holes

In this paper, we present a visualization system which supports to identify and visualize structural hole spanner in dynamic networks and analyse the evolution of spanners. We consider identifying and visualizing structural hole spanners in dynamic networks as an uncertain ranking problem: the rank of a certain node is a distribution of ranks measured by different metrics. A temporal clustering algorithm is firstly applied to cluster nodes into different clusters with the same temporal trend. A novel visual representation is designed to show both the temporal trend of ranks and the uncertainty of the rank at a certain time step. A detailed view is also integrated to support further exploration of the structure around the spanner users interested in.

The contribution of this paper can be summarized as:

- Present a visual framework to identify structural holes
- Propose a novel visual representation for structural holes
- Combine ensemble data visualization with dynamic network visualization
- Develop a visual analysis system that supports analyzing evolution of structural holes

The remainder of this paper is organized as follows. Section 2 reviews related works on dynamic network visualization, ranking visualization, and ensemble data visualization techniques. In section 3 we describe the measure of structural hole spanners. Section 4 presents the system design. In section 5, we report two use cases and an user study. In section 6, we conclude and discuss future work.

2 RELATED WORKS

2.1 Structural Holes

2.2 Dynamic Network Visualization